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CASE REPORT

ADVANCED

CLINICAL CASE

Aortofemoral Bypass Graft Access for Impella Placement

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ABSTRACT

Left ventricular support with Impella requires a large-bore sheath. Alternate access sites have often been required in patients with severe peripheral artery disease. This paper reports the first case in which an aortofemoral bypass graft for Impella access was used in a patient without other alternatives and the method of access closure. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2019;1:751–4) Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

CASE

Percutaneous left ventricular assist devices have allowed extension of percutaneous coronary intervention (PCI) to critically ill patients who in whom surgery is prohibited. As large-caliber sheaths are required for insertion of these devices, severe peripheral vascular disease is a relative contraindication for placement using the femoral approach. In this circumstance, alternative access sites, particularly axillary, have been shown to be viable options in some patients (1–4). This paper reports the first case in which Impella heart pump (Abiomed, Danvers, Massachusetts) access was performed through a polyester polytetrafluoroethylene (PTFE) aortofemoral bypass graft, where other access points, including axillary, were not available and an approach to sheath removal.

LEARNING OBJECTIVES

- To use the Impella in a critically ill patient with severe peripheral vascular disease in whom surgery is prohibited.
- To share decision making and pre-planning with a vascular heart team approach is key when these patients are undergoing high-risk protected percutaneous coronary intervention.
- To use the polytetrafluoroethylene bypass graft as an access site, when available, for Impella passage. This has not been described before.

PRESENTATION. The patient was a diminutive 66-year-old woman (weight: 50 kg) initially admitted for hypoxic respiratory failure. She had severe peripheral artery disease and had previously undergone aortobifemoral bypass surgery. On admission, the patient was hemodynamically stable with a blood pressure of 139/64 mm Hg and a pulse rate of 75 beats/min. Laboratory studies showed hemoglobin concentration of 9.4 mg/dl and lactate of 0.9 mmol/l. Arterial blood gas showed a pH of 7.38, Pco_2 of 55 mm Hg, and po_2 of 95 mm Hg (on 40% oxygen). Electrocardiography showed no ischemic changes, but the troponin level was modestly elevated (0.7 ng/ml [normal <0.03 ng/ml]).

MEDICAL HISTORY. The patient had a history of hypertension, severe chronic obstructive pulmonary disease on home oxygen, Graves' disease,

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Informed consent was obtained for this case.

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ABBREVIATIONS AND ACRONYMS

LM = left main

PCI = percutaneous coronary intervention

PTFE = polytetrafluoroethylene

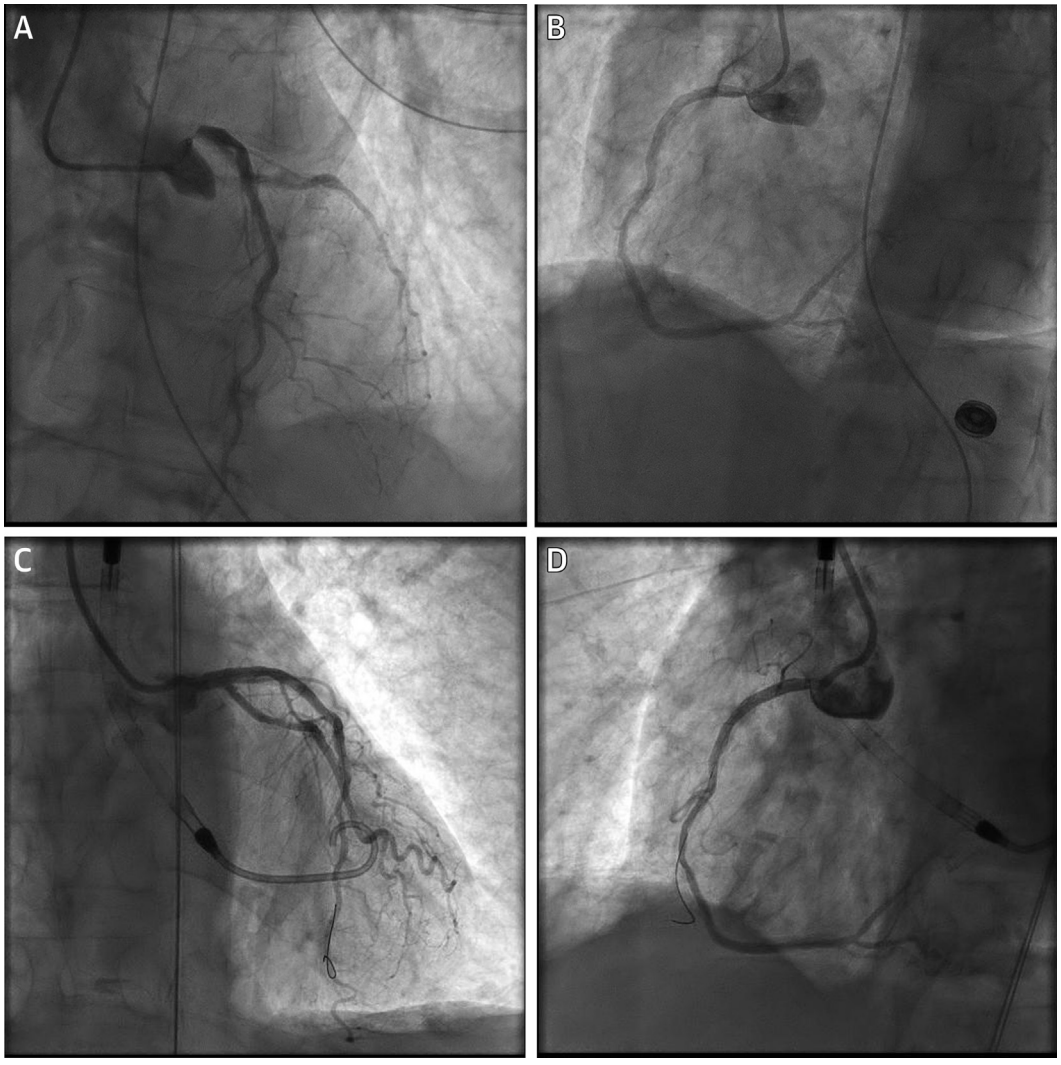
RCA = right coronary artery

pre-diabetes, anemia, and peripheral vascular disease with previous aortobifemoral bypass surgery.

INVESTIGATIONS. After the patient showed clinical improvement of respiratory insufficiency, echocardiography showed decreased left ventricular function (ejection fraction: 30% to 35%) with mild anterior and septal hypokinesis. Catheterization from right radial access showed 90% stenosis in the left main (LM) artery and 99% stenosis in the ostial right coronary artery (RCA) (**Figures 1A and 1B**, Videos 1 and 2). Abdominal aortography was planned but not performed because a catheter could not be passed into the descending aorta from the right radial artery. Two surgical groups refused the patient for bypass surgery. The patient agreed to proceed with PCI under left ventricular support.

The procedural approach was discussed with the vascular surgery team. Given the patient's size, axillary vessels were considered too small for access. It was decided to insert an Impella pump through the right limb of the bypass graft and to remove the access sheath surgically.

FIGURE 1 Severe Stenoses of the Left Main and Right Coronary Arteries



(A) Severe stenoses of the left main and **(B)** right coronary before percutaneous coronary intervention are shown. **(C)** Excellent angiographic results were obtained with the intervention right coronary artery **(D)**. See Videos 1, 2, 3, and 4.

MANAGEMENT: MEDICAL INTERVENTIONS. Graft access was obtained using fluoroscopy and ultrasonographic guidance, using the micropuncture technique with the wire passing easily up through the bypass graft. However, passing a micro sheath was challenging. The sheath (4-F Micropuncture access kit, Cook Medical, Bloomington, Indiana) could not be passed. A dilator alone passed. A 21-gauge needle was then passed over the micropuncture wire to create a larger hole through the polyester graft, but again it was unsuccessful. A stiffer micro sheath (Prelude Sheath, Merit Medical System Inc, Salt Lake City, Utah) was able to be passed into the graft. An Amplatz 0.035-inch extra stiff wire (Boston Scientific, Marlborough, Massachusetts) was passed to the central aorta; sequential dilations with 8-, 10-, and 14-F dilators were applied, and a 14-F Impella sheath was inserted successfully. Angiography of the sheath and abdomen showed patent aortobifemoral limbs with reasonably sized aorta above the graft insertion (**Figure 2**).

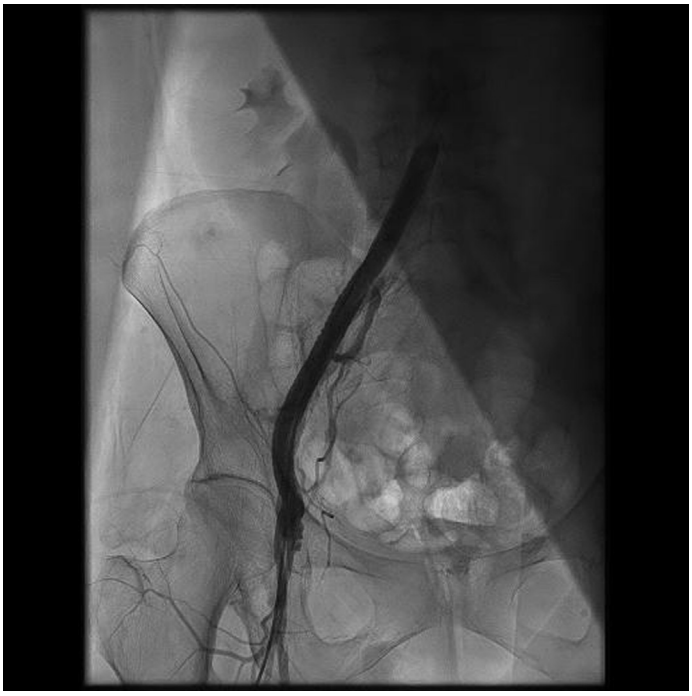
The LM artery intervention was successfully performed using balloon angioplasty (1.5-mm- followed by a 2.5-mm-diameter balloon). A 3- × 8-mm drug-eluting stent (Xience Alpine, Abbott Laboratories, Abbott Park, Illinois) was implanted and post-dilated using a 3.5- × 8-mm noncompliant balloon (**Figure 1C**, Video 3). Intravascular ultrasonography showed a well-expanded and apposed stent with a minimal lumen diameter of 7.4 mm^2. RCA intervention was challenging due to poor guide seating (the right Judkin 4, left Amplatz 1, right Amplatz 2, 3DRC (Three Dimensional Curve), and right Amplatz 1 catheters were not well seated). A right Amplatz 1 guide was seated near the RCA ostium, and a Pilot 50 (Abbott Laboratories) was manipulated into the RCA after Runthrough (Terumo, Elkton, Maryland) and Fielder XT (Asahi, Tokyo, Japan) had failed. A Resolute (Medtronic, Boulder, Colorado) 2.5- × 15-mm stent was deployed (**Figure 1D**, Video 4).

The patient was weaned from the Impella pump in the catheterization laboratory and then taken directly to the operating room for sheath removal. The graft limb was surgically exposed while the patient was under local anesthesia and sedation. Proximal and distal control around the sheath was obtained, and the sheath was removed. The puncture site was closed with a single polypropylene suture. The groin was closed in 3 layers.

DISCUSSION

Severe peripheral vascular disease may prevent the placement of an Impella pump from femoral access. As a result, alternate access sites have been used.

FIGURE 2 Angiography Shows the Large Size of the Bypass Graft and Aorta Proximal to the Graft Insertion



Protected high-risk PCI has been performed with Impella pump support through the axillary and carotid approaches and, most recently, by using a transcaval approach (1–8). This report is the first case of a bypass graft being used as the access site for Impella access.

It is important to remember that polyester PTFE and arterial tissue have different physical characteristics. In this regard, whether percutaneous closure is appropriate is currently uncertain. It is usually recommended that a vascular closure device be avoided (9) because prosthetic graft material has lower compliance than the native artery and poorer elastic recoil and there are concerns regarding puncture sealing (10). One recent case series described percutaneous vascular closure of PTFE grafts, suggesting that the Angio-Seal vascular closure device (St. Jude Medical Inc., Minneapolis, Minnesota) provides more effective and safer closure than the StarClose device (Abbott Vascular). Both devices, however, were associated with an unacceptably high complication rate (Starclose: 71.4%; AngioSeal: 13.9%) (11). Presently, only 1 case of closure was performed by using the suture-based Perclose device (Abbott Vascular), which was successful but later was found to be the nidus of infection requiring surgical removal and vessel repair (12).

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As treatment in critically ill patients becomes more challenging, shared decision making among vascular heart team members can facilitate optimal decisions. Pre-planning with the vascular surgeon was invaluable in the present case in executing an efficient and safe removal of the sheath. It should be noted that particular care to puncture the graft well away from the anastomotic suture line is important to avoid disrupting the graft or creating unnecessary trauma at the suture line.

FOLLOW-UP. The patient continued to improve. After a subsequent stay of 17 days in-hospital due to partial small bowel obstruction, the patient was transferred to a rehabilitation facility. After 10 days, she was discharged to home. Outpatient follow-up 6 weeks after the intervention showed the patient to be fully functional at home, limited only by her respiratory condition.

CONCLUSIONS

This case demonstrates that large-bore access through an aortofemoral bypass graft for Impella access is feasible and that surgical closure can be straightforward. It provides another option in applicable patients.

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APPENDIX For supplemental videos, please see the online version of this paper.